To-day, the forty-fifth since the operation, the eye is very nearly in its normal position, and follows the movements of its fellow accurately. Dr. Thomson has at my request examined the eye, and informs me that he finds it, corrected with a glass of 5 dioptrics, to possess an acuity of vision of $\frac{20}{L} = \frac{1}{2\frac{1}{2}}$. There is slight astigmatism, which might be more closely corrected by a cylindrical glass. Vision is binocular. Hence it may be justly claimed that there is no loss of sight; and with suitable glasses she would now be able to read or work as she did thirty years ago. The wound has left very little scar; the greatly redundant skin in the upper lid has been much reduced by shrinkage, which process is still going on, so that she feels herself daily lifting the lid better and better.

The tumour, which was about the size of a hen's egg, flattened above and below, was submitted to Dr. Morris Longstreth for microscopic examination, and was found to be a spindle-celled sarcoma.

This case seems to me chiefly remarkable on account of the very slow growth of the tumour, the slight interference with the nutrition of the eye itself and of its appendages, and the ease with which it was enucleated. As to its origin, there is perhaps room for some doubt; it did not seem to be connected with the lachrymal gland, which I think was left untouched; and I would hazard the suggestion that it may have been developed from a blood-clot effused at the time of the severe confinement mentioned as having occurred in 1847.

Another point of interest is the complete restoration of the organ to its normal position, and the preservation of the movements in spite of the long and apparently extreme stretching to which the muscles and nerves had been subjected.

Two matters connected with the operation may be further referred to. One is the oblique mode of incision, by which the scar was rendered almost a mere hair-line. The other is the use of the drainage-tube, which prevented all risk of bagging of pus in the space left by the removal of the tumour.

The literature of the subject is so readily accessible that I content myself with simply placing this case upon record, without quoting the opinions or statements of others.

1924 Spruce Street, Philadelphia, May 14, 1879.

ARTICLE XIII.

CONTRIBUTIONS TO THE MINUTE ANATOMY OF THE LIVER.[1] By WILLIAM G. DAVIS, M.D., of Philadelphia.

IN investigating the anatomy of the liver, the proper injection of the vessels is a matter of the greatest importance. The principal vessels to be injected are the venous, the arterial, and the biliary capillaries. In injecting any of these, the one fact constantly to be borne in mind is that the liver must always be kept warm and moist. Its surface should not be exposed to the air. To harden the specimen, Müller's fluid or alcohol may be used. The former is only to be employed with uninjected specimens or those injected solely with Prussian blue, as it destroys the colour of carmine. Specimens injected with carmine should be put into weak alcohol, to which a little acetic acid has been added. Specimens preserved in Müller's fluid may be transferred from it to a concentrated alcohol for a few hours before making sections. Specimens injected with nitrate of silver should be transferred to the freezing microtome, and sections made immediately. These sections should then be exposed to the light. The fluids used for injections are of two kinds—gelatine masses and cold flowing liquids. For the bloodvessels a solution of gelatine should be used. It may be coloured with carmine, Prussian blue, or chromate of lead. For the bile ducts, a watery solution of Prussian blue may be employed. The blue used in this case was a washing blue called "cream indigo."

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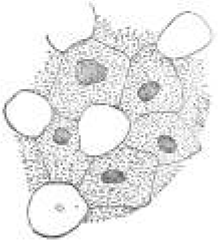
[1] Abstract of an Inaugural Thesis presented to the Medical Faculty of the University of Pennsylvania, and to which was awarded the Henry C. Lea Prize.

To demonstrate the epithelium of the bloodvessels, the latter may be injected with .25 or .5 per cent. solution of nitrate of silver. This should be followed by an injection of warm water, and the liver then transferred to the freezing microtome. Liquids containing glycerine should be avoided, as it is impossible to harden the specimen either by freezing or with alcohol. For staining, Beale's carmine or hæmatoxylon may be used. The slightest trace of acid destroys the colour of the latter.

Hepatic Cells.—These are rounded in form, and lie embedded in the vascular and biliary capillary network. Their form is dependent on the amount of pressure in the bloodvessels. When the latter are empty, the cells are rounded; when they are distended, the cells where they touch each other are flat; where they touch the bloodvessels, they are notched (fig. 1). Excessive vascular distension causes the cells to appear as narrow bands of granular matter. They do not possess walls (contrary to Schmidt,[1] but in accord with Frey[2]). According to Pflüger,[3] they have walls which are continuous with the bile capillary walls. According to Kolatschewsky,[4] the substance of the cells is continuous with the same. This has not been observed, though carefully looked for.

Fig. 1.



Liver of Rabbit, showing cells modified by distension of the bloodvessels.

Hepatic and Portal Veins.—In injecting the venous capillaries, the hepatic vein should always be chosen. Injecting by the portal vein necessitates so much exposure of the organ that the injection at best can only be partial. The animal being etherized, an incision is made in the right lumbar region. The ascending cava is then ligated just beneath the edge of the ribs. The incision is then to be closed with two or three stitches. With a strong pair of scissors a large piece is cut out of the right thoracic walls. The hepatic vein (thoracic ascending cava) is now seen coming from the diaphragm. A spring clip should now be put on its diaphragmatic extremity, and a ligature on its cardiac extremity. This prevents the blood coming either from the liver or from the heart. The vein may now be nicked with the scissors, between the clip and ligature, and the canula inserted and tied therein. The injecting syringe being filled, the canula should be cleansed of clots by means of a wire. The clip is now removed, and, as the blood oozes out, the syringe is inserted and the piston pressed gently but rapidly home. The blood leaves the liver and collects in the intestines. The portal and hepatic veins are then ligated. If enough fluid is used, the intestines may also be injected at the same time. The object of ligating the abdominal cava is to prevent the fluid going to the lower extremities. In removing the organ, care should be taken to cut on the distal side of the ligatures.

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[1] Schmidt. Monthly Microscopical Journal, August, 1870.

[2] Frey. Microscope and Microscopical Technology. Amer. ed., 1872.

[3] Pflüger. Archives der Physiolog., 1869, 9 and 10 heft.

[4] Kolatschewsky. Schwalbe's Archiv fur Mik. Anat., 1877.

Hepatic Artery.—As regards the distribution of the hepatic artery, Chrczonszczewsky,[1] Rindfleisch,[2] and Green[3] describe it as ending in the middle zone of the lobule, half way between the portal vein on the circumference and the hepatic in the centre. Beale,[4] Cohnheim und Litten,[5] and Kowalewsky[6] describe it as ending on the periphery of the lobule. We believe that this latter is the correct method, and its demonstration may be accomplished in the following manner: The animal being etherized, an incision is made in the right lumbar region, and the abdominal aorta and vena cava ligated; this may be done with a single thread. The thorax is then opened and a clip placed on the hepatic vein. A canula is then inserted into the thoracic aorta and a cold flowing blue mass thrown downwards. After two or three syringefuls the vessel is ligated. A canula is now inserted in the hepatic vein, and a red gelatine mass injected downwards. As the red liquid flows into the vein, it meets the blue from the artery and washes it out the portal vein. The blue liquid then remains in those capillaries only which are purely arterial, being kept from regurgitating by the ligature on the aorta. The organ may then be removed as before described. In a preparation made in this manner, the artery is seen breaking into capillaries on the border of the lobule and anastomosing with the vein. With Schmidt we have failed to see any branches distributed to the capsule. (See fig. 2.)

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[1] Chrczonszczewsky. Quoted by Cohnheim und Litten. Virchow's Archiv, 1876, pp. 156–165.

[2] Rindfleisch. Pathological Histology.

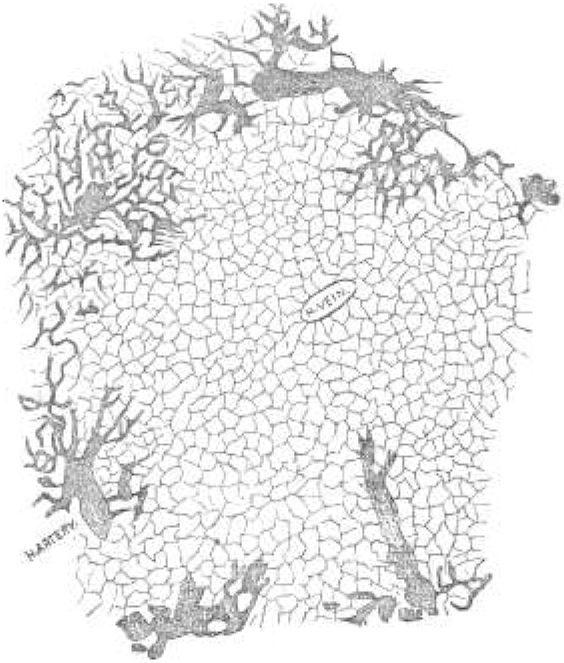
[3] Green, J. Henry, M.D. Introduc. to Path. and Morbid Anat., 1876.

[4] Beale. How to Work with the Microscope, p. 140.

[5] Cohnheim und Litten. Virchow's Archives, bd. 67, 1876.

[6] Kowalewsky. Protocols of the meetings of the Russian Natural Scientists and Physicians, 1876.

Fig. 2.

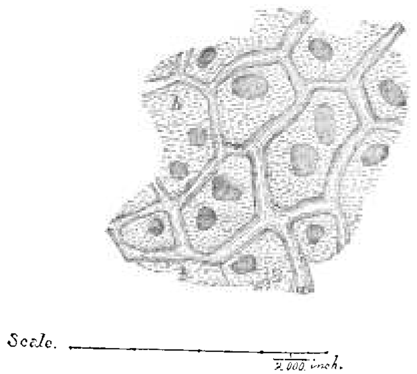


Liver of cat. The artery is seen on the edge of the lobule breaking into capillaries ; these empty immediately into the capillaries which unite to form the hepatic vein.

Hepatic Duct.—In studying the distribution of the duct, it is desirable to have the bloodvessels injected. This may be done as detailed for the portal and hepatic veins. The large vessels being ligated, the liver is to be removed to a capsule of warm water. The ductus communis choledochus should be tied and a canula inserted into the gall bladder. This is just as efficient and easier than to insert it into the duct. The organ may now be injected either with the syringe, or by means of a constant pressure of a column of liquid, or by means of atmospheric pressure. In this last method the capsule containing the liver immersed in warm water is placed on the plate of an air pump. A tube passes from the canula in the gall bladder through an air-tight cork in the top of the bell glass, by which the capsule is covered. The distal end of this tube is immersed in the injecting fluid. A clamp is placed on the tube outside of the bell glass. The air is then to be exhausted. The clamp being very gradually loosened, the liquid flows into the liver; and it should be loosened only enough to allow the gall bladder to be moderately distended. If the clamp is opened suddenly, the gall bladder will burst or extravasations will occur.

Triple Injections may be made by injecting the veins and artery as described under the hepatic artery, and the duct by one of the methods just described. Concerning the exact method of termination of the bile ducts, there is much dispute. Beale[1] still adheres to the tubular structure theory, and regards the bile capillaries as the result of a forced injection. Hering[2] and his followers believe that the bile capillaries exist already as fine channels. Schmidt,[3] Budge,[4] and others hold that the bile capillaries are a distinct system of vessels with walls of their own. Legros,[5] going still further, claims to have demonstrated, by injection of nitrate of silver, the existence of epithelium in the finest bile capillaries. The vastness of this claim is such that we hope we may be pardoned for acknowledging our inability to take it all in. The view of Schmidt and Budge, which describes bile capillaries with true walls, is the one which we think correct. In fig. 3 are seen injected bile capillaries. The spaces are as large as an hepatic cell and *angular* in outline. If they were produced by a forced injection, the liquid would follow exactly the contour of the cells and make round spaces, the capillaries at points of junction being then much larger than between such points. When the liquid came in contact with a bloodvessel, it would surround the vessel and make a curved capillary, but curved capillaries are comparatively rare. If we were able to trace a natural communication between the capillaries and larger bile ducts, it would aid in the consideration of the subject very much. Prof. Beale, referring to this in his last paper, asks why it has not been shown. He says Hering's drawings do not exhibit it, and therefore he denies its existence. We have the good fortune to be able to produce this missing link.

Fig. 3.



Rabbit's liver. Bile ducts injected. *a*. Capillary bile ducts forming angular spaces in which are inclosed the hepatic cells *b*. Some of the cells have two nuclei.

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[1] Beale. Archives of Medicine, 1872.

[2] Hering. Stricker's Manual of Histology.

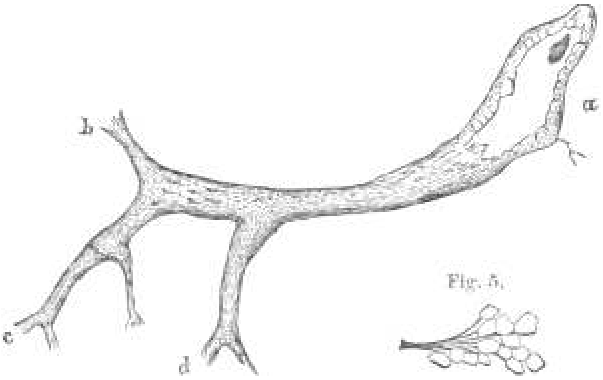
[3] Schmidt. American Journ. of Med. Sciences, January, 1859.

[4] Budge. Archiv. für Anatomie und Physiologie, 1859, p. 463.

[5] Legros. Sur la struct. et l'epithe. propre des canaux sécréteurs de la Bile. Journal de l'Anat. et de la Phys. de l'Homme et des An. 1874.

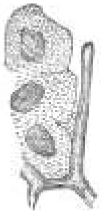
In fig. 4 is seen a longitudinal section of a large bile duct, with its characteristic epithelium and also its blue injection fluid. At b, c, and d it breaks up into capillaries. The capillaries at b are shown increased in size in fig. 5. Each mesh contains usually one hepatic cell. Two nuclei in a mesh may belong to a single cell. The diameter of the capillaries varies with the amount of contained liquid, but is usually from $\frac{1}{14000}$ to $\frac{1}{8000}$ in. in diameter. The former is the more common size. In support of the existence of true walls, we would say that the injection in a capillary has been seen to cease and the capillary continued by a colourless line. This latter is supposed to be the collapsed and empty capillary walls. The angularity of the spaces and the distinct limitation of the capillaries also favours this view. The injected capillaries are sometimes seen to project beyond the edge of the cells, and also at times clinging to their free sides. This is seen in fig. 6. This appearance would be impossible with no true walls. They are known to be bile capillaries by their very small size, and by being continuous with a biliary network. When the pressure has been great, the bile capillaries, instead of being straight, as is natural, are convoluted and tortuous. This would only occur in a tube with true walls. Concerning the relation of the blood to the bile capillaries, we consider, with McGillavry, that it is a matter of accident whether they touch or not. Sometimes they lay along-side of one another, and sometimes

Fig. 4.



Longitudinal section of a bile-duct; cat's liver. At *a* is seen the epithelium; at *b*, *c*, and *d*, the duct is breaking into capillaries.
The lower figure shows the capillaries at *b* more highly magnified.

Fig. 6.

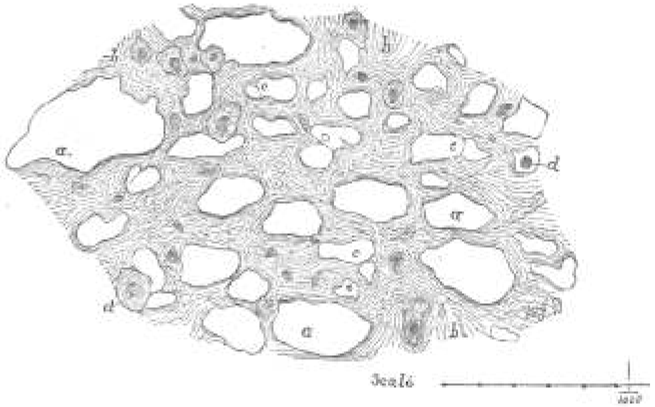


Rabbit's liver. A capillary bile duct is here seen clinging to the free side of three hepatic cells. Injected with a watery solution of Prussian blue.

they cross over each other. This is contrary to Hering,[1] Peszke,[2] and Orth.[3] We do not accept the view of Schmidt that there exists a natural communication between the lymphatics and bile capillaries. The return of the injection fluid by the lymph canals can be accounted for by extravasations into the lymph spaces. This latter we believe we have seen in one instance. The blunt extremities of bile capillaries described by Eberth have been noted, but they are probably due to a cessation of the injecting fluid, and not of the capillary itself.

Connective Tissue.—To demonstrate the intralobular connective tissue, a piece of child's (or adult's) liver, which has been preserved in Müller's fluid, may be used. When a section is made and brushed, a connective-tissue-like network is left. This is not true connective tissue, but consists almost entirely of bloodvessels, as can readily be proven by the remains of blood corpuscles seen within them. The only true connective tissue present consists of fine fibrils which pass from one bloodvessel to another, and also those which adhere to the walls of the vessels. Both are very scanty in quantity. (See fig. 7.) There is no basement membrane of any sort existing between the hepatic cells and the walls of the bloodvessels. What Frey in his work gives as the framework substance of the liver, and calling it a "homogeneous membrane with nuclei," is in reality bloodvessels. Fleischl[4] has also, we believe, mistaken the bloodvessels for connective tissue.

Fig. 7.



Liver of a child: cells removed by brushing.—*a*. spaces left by removal of the cells; *b*. bloodvessels; *c*. connective tissue fibrils crossing from one vessel to another; *d*. hepatic cells.

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[1] Loc. cit.

[2] Peszke. Beitrage zur kenntniss des feinern baues der wirbelthier leber. Dissert, Dorpat, 1874.

[3] Orth. Cursus der Normalen Histologie. Berlin, 1878.

[4] Fleischl. Ber. d. Königl. ges. d. wiss. 1874, tafel I.

Lymphatics.—An attempt was made to demonstrate these by means of a method suggested to me by Dr. E. O. Shakespeare. The abdomen of an etherized animal was opened and a stick of diluted nitrate of silver rubbed over the surface of the liver. In a half an hour the animal was killed and sections made with the freezing microtome. In the two experiments made in this manner, the peritoneal surface was coloured with the nitrate of silver, but there were no lines going inward to indicate the course of the deep lymphatics.

ARTICLE XIV.

SANITARY DRAINAGE. By M. CAREY LEA, Esq., of Philadelphia.

IT is only of late years that attention has begun to be intelligently directed to the dangers which we have introduced into our houses together with the "modern conveniences." The investigation of the subject has revealed both ignorance and recklessness—ignorance of the laws which govern the movements of mixed liquids and gases in more or less confined tubes, and recklessness in introducing fixtures connected with sewers and imperfectly protected from sewer gas into confined spaces adjoining sleeping rooms, and connected with them. The results have been such as to make it evident that there exists a pressing need for a wide diffusion of knowledge on the subject of drainage, especially amongst medical men, in order that they may insist on a radical change in certain of the methods now in use. For want of this reform, it is no exaggeration to say that not a house in a hundred in any of our large cities is properly protected from sewer gas.

Soil Pipes and Traps.—To correctly understand the workings of our most common arrangements for drainage, it is desirable to obtain an insight into the nature of the movements of currents of water and air mixed in tubes.

Over the pipe of a water faucet let us attach a few feet of rubber tube, and insert in the other end of the rubber tube a glass tube as thick as a quill, and two or three inches long. Let another glass tube of half an inch internal diameter and three or four feet long be held vertically in a glass beaker. If now we insert the small glass tube into the upper end of the vertical tube, and turn on water, we shall find that the water in descending carries with it a great quantity of air, which becomes entangled in the descending current, and rises tumultuously in bubbles in the beaker.[1]

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[1] The principle here involved is used on a great scale in Catalonia for providing an air blast for furnaces. Mountain streams are conducted over steep cliffs and into large pipes, too large to be filled by the stream, which in descending produces a powerful and steady blast of air.